Papers read before section G, A. A. A. S., Brooklyn meeting, 1894.

GALLOWAY, B. T.: *The growth of radishes as affected by the size and weight of the seed.*—The relation of the weight of the seed to the weight of the products was considered, and the physiological questions involved discussed. It was shown that by using large seed about 90 per cent. of the crop reaches marketable size at the same time. Where mixed seed are used, or seed as it usually comes from the market, from 45 to 50 per cent. only of the crop matures at the same time. In other words, by using large seed 90 per cent. of the crop will mature in from thirty-five to forty days, and where large and small seed are used about 50 per cent. of the crop will mature in the same time.

GOLDEN, KATHERINE E.: *Movement of gases in rhizomes.*—Rhizomes are usually transversely geotropic organs, having stored in them elaborated food. Their epidermis is free from stomata and lenticels, so that the gas found in them can enter through the epidermis only, the tissue absorbing it from the surrounding air. The rhizomes used in the experiments were those of Mentha piperita, Helianthus grosse-serratus, Solanum tuberosum, and Mimulus moschatus, the epidermis of all being unlignified and unsuberized, the outer wall thickened and the cells packed so closely together as to form an imperforate membrane. The inner tissue was made up nearly entirely of parenchyma, having large intercellular spaces through which gases, after gaining access to the interior, could very readily permeate.

1. In the majority of rhizomes examined the contained gases were under greater pressure than the atmosphere, an interval of twenty to twenty-five minutes being required for the pressure of the gases in 1^{mm} of the rhizomes to become the same as the pressure of the atmosphere. The method of procedure was to space off rhizomes into definite lengths, the rhizomes being then placed under water and cut at varying intervals of time, the bubbles of gas, as they rose through the water, being easily seen. The next point determined was the rate of passage of gases through definite lengths of rhizomes that were fastened in tubes filled with mercury. The

descent of the mercury in the tubes showed the rapidity of the passage of the gas. Gas passed through rhizomes very rapidly for the first hour, though becoming slower towards the end of the hour, and finally, as the rhizomes became saturated with the gas, becoming so slow as to take some times a day for the mercury in the tube to come to the level of that outside. The gas passed more rapidly through short than long lengths of rhizomes.

2. To determine passage of gas through sections of epidermis under pressure, sections of epidermis were fastened on the end of a glass tube, which was then filled with mercury and placed in a vertical position in a vessel of mercury. The mercury remained at its original height for days, though the sections would become concave from the pressure on them.

3. To determine amount of diffusion of gases without pressure through living plant membranes and dead plant and animal membranes, sections of hog's bladder and living and dead epidermis were fastened on tubes as before, the tubes being filled with water instead of mercury, the water then being displaced by the gas. The sections permitted considerable diffusion to take place, though the greater amount was attained by the living plant membrane.

4. To determine rate and amount of diffusion of gases through both epidermis and internal air cavities, lengths of rhizomes were fastened air-tight into tubes, the end of the rhizomes extending into the tube being sealed. The tubes were then filled with gas as before, carbon dioxide, hydrogen, and ammonia being used. The ammonia killed the plants so that no comparison between it and the other gases could be made. The carbon dioxide showed greater rapidity and amount of diffusion, and was uniform in diffusing, whereas the hydrogen was subject to fluctuations, the mercury in the tube sometimes dropping to the level of that outside. Both gases diffused more rapidly when the temperature was low, the high temperature very probably causing the gas to exert sufficient pressure to hinder diffusion. The individual plant was the factor of greatest importance, as like plants under similar conditions showed variations in the rate and amount of diffusion.

BEAL, WM. J.: *The sugar maples of Central Michigan.*— Descriptions of A. barbatum and the var. nigrum were given. It was shown that *A. saccharum barbatum* Trelease is not even a variety, as it is found growing on the tops of numerous trees of the species. A summary of comparisons of *A. barbatum* and *A. barbatum nigrum* was given. It was shown that color of branches and stems, shape of top, number of leaf lobes, depth of sinus, leaf-texture, could none of them be used as diagnostic characters. Intermediate forms between the species and variety were also noted and the author inclined to the conclusion that the varietal rank of A. barbatum nigrum is reasonably established.

COULTER, JOHN M.: *Some affinities among Cactaceæ.*—A study of our species of *Cactus* (Mamillaria), *Anhalonium*, and *Lophophora* has suggested certain lines of genetic affinity, indicated by the relative position and structure of the tubercles, spines and flowers. In the discussion the two subgenera of Cactus (Eumamillaria and Coryphantha) were considered separately. Eumamillaria is characterized by its grooveless tubercle, which bears at its summit the spine-bearing areola, and in its axil the flower-bearing areola. Coryphantha shows the same relative position of the two areolæ but they are connected by a deep woolly groove running down the upper face of the tubercle; in fact, the two areolæ seem to be but expansions of the groove at its extremities. In *Echinocactus* the two areolæ become contiguous at the summit of the tubercle. The relation between Echinocactus and Coryphantha is made evident by intermediate forms, in which the groove gradually shortens, making the flower areola more and more extra-axillary, so that it gradually ascends the tubercle, until reaching its summit and becoming contiguous with the spiniferous areola, the resulting form is an Echinocactus. Whether the groove has gradually shortened or lengthened is not clear, but the indications are that the Echinocactus condition has given rise to Coryphantha, and that, in turn, by the closing of the groove, to Eumamillaria. Related to these forms are two aberrant genera, now regarded as such, but frequently variously referred to Cactus (Mamillaria) and Echinocactus, viz: Anhalonium and Lophophora. The real affinities of these two genera are indicated upon an examination of their growth. The very young tubercles of Anhalonium are those of Coryphantha, such as those of Cactus macromeris, with the floriferous areola extra-axillary, the woolly groove extending about half way down the tubercle. In later development, however, the upper and lower portions of the tubercle become much modified and very different from each other, the upper portion becoming a very thick triangular bract, in some cases preserving the woolly groove, in other cases the groove being obliterated and appearing only as a minute tuft at the tip. In all cases the spiniferous areola is completely obliterated. It seems evident that Anhalonium is an offshoot from forms intermediate between Echinocactus and Coryphantha.

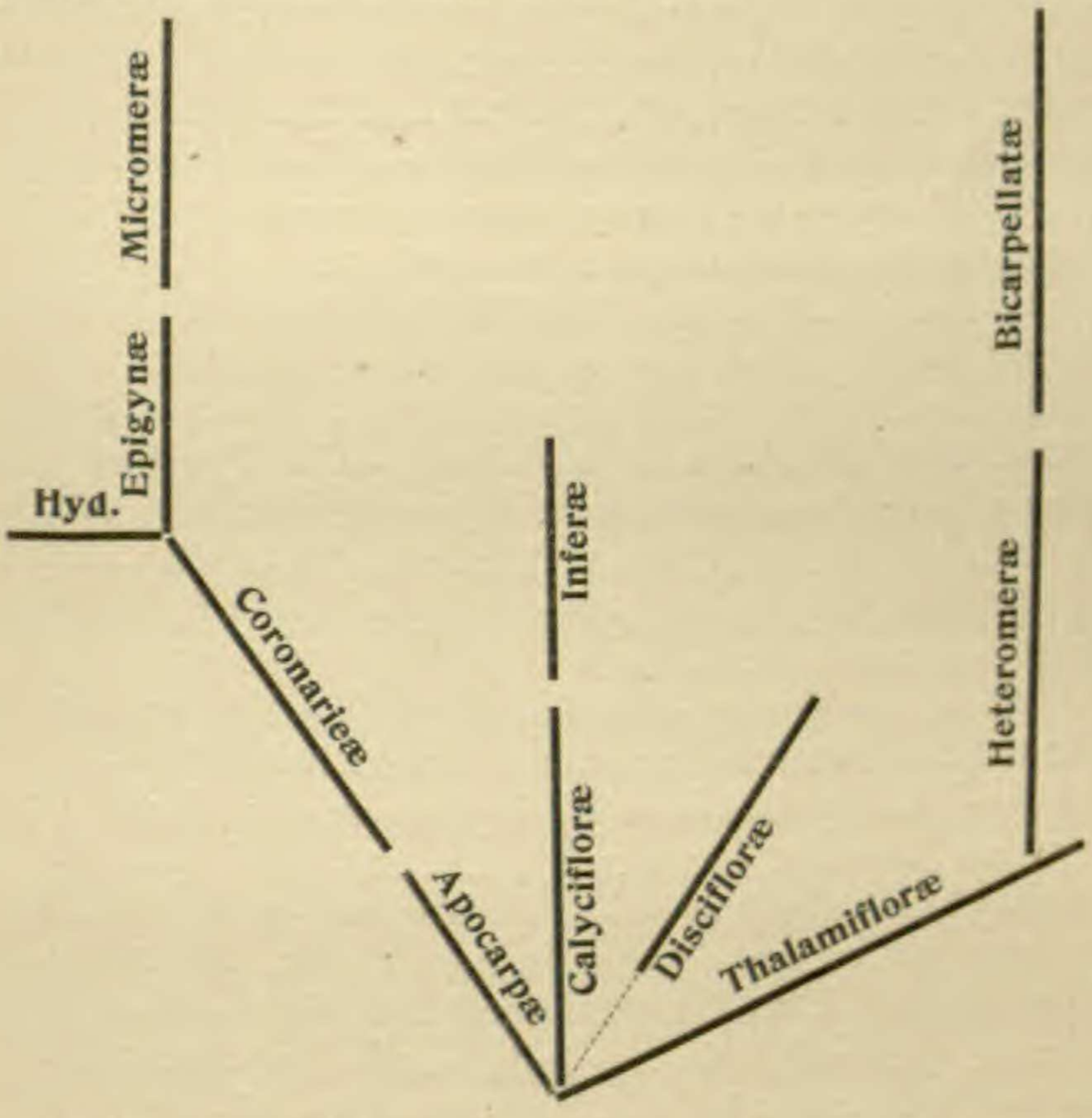
Lophophora has been still more puzzling, as it shows a grooveless tubercle, upon the summit of which is the floriferous areola, suggesting at once Echinocactus, to which the forms have mostly been referred. However, the entire disappearance of a spiniferous areola should suggest doubt. The very young tubercle of Lophophora shows the floriferous areola below the summit, but the small tip develops no further, while the floriferous areola becomes terminal by the large development of the lower portion of the tubercle into a broad mass, in the center of which the floriferous areola appears as a small depression with a penicellate tuft of hairs.

In conclusion, in the group of forms under consideration, Echinocactus is suggested as the primitive one, with its grooveless tubercles bearing at summit the contiguous areolæ. The formation of a groove separating these slightly at first, and finally carrying the floriferous areola to the axil of the tubercle, has given rise to Coryphantha, intermediate forms having given rise to the aberrant genera Anhalonium and Lophophora; while the closing of the Coryphantha groove has given rise to Eumamillaria. It may be that this evolution has proceeded in the opposite direction, from Eumamillaria to Echinocactus, but it would not change the relative position of the genera here suggested.

BESSEY, CHARLES E.: *Simplification and degeneration of structure in the angiosperms.*—The speaker emphasized the thought that evolution proceeds in the direction of increasing simplification as well as of increasing complexity. The Umbelliferæ and Compositæ were used as illustrations of groups of high rank in which there has been a simplification of the floral parts. This is not to be confused with real degeneration, such as occurs in dodder and mistleto.

NEWCOMBE, F. C.: *Regulatory growth of mechanical tissue.*—To be published in full in this journal.

BESSEY, C. E.: *Further studies in the relationship and arrangement of the families of flowering plants.*—The paper presented a brief discussion of the primitive flower of the monocotyledons; modifications of the primitive flower by increased complexity of structure; the origin of sedges and grasses; development of irises and orchids; the primitive flower of the dicotyledons; modifications by increased complexity; modifications by simplification; development of the Bicarpellatæ and of the Inferæ. It was accompanied by the following chart of suggested changes in the arrangement of groups in accordance with genetic lines.



Smith, Erwin F.: *The watermelon disease of the South.*—This is a disease of the vine of hitherto unknown origin, widely prevalent in the melon districts of the southeastern United States and so destructive that growers in Georgia believe that it is impossible to raise melons in the same field two years in succession, or oftener, with profit, than once in 5 to 7 years. In some districts in Georgia and South Carolina the disease has this year reduced shipments one-third to one-half, and in the worst cases has taken the whole crop of individual growers.

Large vines in full vigor wilt suddenly, without apparent cause. This is followed in a few days by the death of the vine, but during this period there are no external indications of parasites, either above ground or below. The cortex is turgid, free from spotting, and normal in color at the time the leaves begin to wilt.

Constantly associated with the earliest stage is a fungus apparently undescribed and to which I have given the provisional name, *Fusarium niveum.* It occurs in the ducts of the stem, filling them more or less completely and interfering with the movement of water from roots to foliage. The fungus was most abundant near the crown, but it was found in many parts of the root system and in the vessels of the stem abundantly as far as $0.5-1.5^m$ away from the roots.

This fungus gains entrance through the root system, and there are some indications that this infection takes place principally within the first few weeks after planting. At that time all the tissues are attacked, in hot wet weather damping off the seedlings as energetically as a Pythium. Later the parenchyma becomes more resistant, and the fungus betakes itself to the bundles, and especially to the ducts, but when the stem begins to shrivel it is again found invading the parenchyma.

Conidia are produced abundantly within the vessels of the vine and pure cultures have been made from these.

The most badly attacked fields observed in South Carolina were those heavily fertilized with barnyard manure made from what is locally known as "watermelon hay," i. e., wild grass, cut in autumn from melon fields, including many blighted vines. This is composted and put back on the fields at time of planting. In my judgment a modification of the method of manuring, a judicious rotation of crops, and the prompt destruction of diseased vines would do much to lessen the prevalence of this disease.

ATKINSON, GEO. F.: *Preliminary note on the relation between the sterile and fertile leaves of Onoclea.*—The complete differentiation between the fertile and sterile leaves of *Onoclea sensibilis* suggested that the so-called var. *obtusilobata*, which is an intermediate state, could be artificially induced by amputating the early vegetative leaves of this fern. The leaves were then cut from a patch of this fern on May 11th, June 9th, and July 12th, respectively. On July 12th, a few leaves were seen which showed the transition stages. On August 8th and 9th the plants were gathered and every conceivable gradation between the fertile and sterile leaves was present, as illustrated in over thirty specimens. Some leaves of the fertile kind were expanded to a size equal to that of large sterile leaves, but usually the venation was coarser and a few rudimentary indusia could usually be found on the basal pinnules of the lower pinnæ. Some leaves were found which it was impossi ble to properly correlate. The number and perfection of the sporangia as well as the indusia varied in accordance with the variation of the leaves. On those leaves or parts of leaves where but few or rudimentary sporangia were developed, there were frequently cases of apospory, rudimentary prothallia being developed from the placental region.

RUSBY, H. H.: *Lophopappus, a new genus of mutisiaceous Compositæ, and Fluckigeria, a new genus of Gesneriaceæ.*—The author gave the general characters of the groups to which the new genera belong, their positions in such groups, the occurrence of the plants on which the new genera are based, and the description of the latter.

ATKINSON, GEO. F: *Preliminary note on the swarm spores of Pythium and Ceratiomyxa.*—Recent study of the "damping off" fungus from fern prothallia and green house cuttings of dicotyledons has served to show that considerable confusion exists concerning our knowledge of the swarm spores of the genus *Pythium*, or that the genus is a very heterogeneous one. In DeBary's[1] earlier work he says that *P. proliferum* possesses oval uniciliate zoospores, and that occasionally double zoospores made their escape before they were completely formed. These possessed two cilia and later divided into uniciliate zoospores. *P. reptans*[2] on the other hand has biciliate zoospores, which are reniform, and the cilia on one side not far from the end. Without division these rounded off and germinated. In the later work[3] he places *Pythium* in the Peronosporaceæ and says the members of the family possess swarm spores with twolateral cilia. Schrœter[4] characterises the swarm spores of his family Pythiaceæ as being reniform

[1]Einige neue Saprolegnieen. Prings. Jahrb. f. wiss. Bot. **2:** 185. 1860.
[2]Ibid. p. 187-8.
[3]Beitr. z. Morph. u. Phys d. Pilze **4:** 93. 1881.
[4]Engler u. Prantl's Natürlich. Pflanzenfam. **1:** —. —.

with two lateral cilia, and yet introduces Hesse's figure of *P. DeBaryanum* with oval uniciliate zoospores.

According to Pringsheim,[5] *P. entophytum* has uniciliate zoospores. *P. cystosiphon* Lindstedt *(Cystosiphon pythioides* R. & C.), according to Roze and Cornu[6], has reniform swarm spores, the two cilia arising from the pointed ends instead of from the side. *P. Equiseti* Sadebeck,[7] which DeBary[8] places as a synonym of *P. DeBaryanum*, has swarm spores exactly like those of *P. cystosiphon*. *P. DeBaryanum* Hesse, as indicated above, has, according to its author, oval uniciliate swarm spores.

The Pythium which I have studied from the botanical conservatories of Cornell University is what I have supposed to be the *P. DeBaryanum* Hesse, and is probably what usually passes for that fungus in America. The peculiarities which I have observed are as follows: The swarm spores in process of formation are reniform with rounded ends, the developing cilia issuing from the broadly rounded ends, which because of the form of the body are turned to one side. On issuing from the swarm-sporangium they are long reniform with pointed ends and a cilium is attached to each end directly at the point. After swarming for a while amœboid movements ensue without the loss of the cilia. Soon a constriction appears and eventually the swarm spore divides into two oval uniciliate swarm spores. These swarm again and eventually come to rest and germinate. The questions arise whether these discrepancies are due to imperfect observations on the part of some, or whether there are specific differences according to the character of the zoospores, or whether all are at first biciliate, becoming later uniciliate, or whether there is great variation in the different species in this respect, so that at one time both kinds of zoospores will be developed and at another time only one kind. These questions I shall not attempt at this time to answer.

In studying the germination of the spores of a species of *Ceratiomyxa* Schrœter[9] *(Ceratium* A. et S.), a form was used

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[5]Prings. Jahrb. f. wiss. Bot. **1**: 289. 1859.

[6]Sur deux nouveaux types génériques pour les familles des Saprolégniées et des Péronosporées. Ann. d. Sci. Nat. Bot. V. **11**: 78. 1869.

[7]Unters ü. Pythium Equiseti. Cohn's Beiträge z. Biologie d. Pflanzen **1**: 121. 1875.

[8]Zur Kenntniss der Peronosporeen. Bot. Zeit. **39**: 528. 1881.

[9]Engler u. Prantl's Natürlich. Pflanzenfam. **1**: 16. —.

which may be the type of a new species to be known as *C. plumosa.* The sporophores possess a stout base but are very profusely and finely branched, very much more so than *C. mucida* (P.) Schrœt., and have been chiefly found on rotting elm and basswood stumps or logs. Spores freshly matured and sown in pure water before drying germinated within two to six hours.

The germination differs from that of any other genus of the Myxomycetes. Through a small perforation in the wall of the spore the protoplasm escapes slowly as a vermiform body which possesses tortuous motions and slight amœboid movement of the surface. In the course of fifteen minutes to one hour this shortens and becomes amœbiform, the developing pseudopodia being quite short and slender but longer than those on the vermiform body. Four rather clear spaces appear in the protoplasm which precede the simultaneous parti-division of the mass into a four-lobed body. These then farther divide once forming an eight-lobed body; minute pseudopodia developing the meantime over the surface of all the lobes. A single long cilium is now developed from the end of each lobe and quite violent lashings follow accompanied by the continued development of the pseudopodia.

The individual lobes separate frequently in pairs which remain for a time in communication but eventually separate. Sometimes three to six may remain joined for several hours assuming various shapes, but always showing the individual lobes and the long cilium. These frequently simulate the form of a star fish.

Famintzin and Woronin[10] have studied the germination of the spores of *Ceratiomyxa mucida* (P.) Schrœt. *(Ceratium hydnoides* A. & S.) and their account differs somewhat from that which I have observed. In the first place they were not able to germinate the spores until after they had passed a period of drying, and then only in a nutrient medium formed by a solution of rotten pine wood in water. They were not able to induce germination in water alone. The spores germinated only after about thirty hours from the time of sowing. On germination there was no vermiform body but the amœboid form issued directly, and division began by bi-partidivision instead of quadro-parti-division and continued up to the eight-lobed body when they separated in pairs.

[10] Ueber zwei neue formen von Schleimpilzen: Ceratium hydnoides A. et S., u. C. porioides A. et S. Mém. d. l' Acad. Imp. d. Sci. d. St. Petersbourg, **20**: –. 1873. [No. 3.]

It is difficult to believe that specific differences would account for the differences in the observations, nor can we suppose that Famintzin and Woronin overlooked the vermiform body in the first stage of germination. Probably there may be some variation in individuals in this respect.

BRITTON, ELIZABETH G.: *A revision of the genus Scouleria.*—The author described the type of the genus, *Scouleria aquatica*, and reduced *S. Nevii* Kindb. and *S. Muelleri* Kindb. to it. *S. marginata* was described as a new species. The paper was illustrated by drawings and specimens.

WILDER, BURT G.: *Evidence as to the former existence of large trees on Nantucket Island.*—Fragments of large trees have been found while cutting peat at Polpis, Hughes' Neck, and the author saw in this bog a stump 1.75^{m} in circumference. Near by as many as twenty stumps of various sizes were found.

BRITTON, N. L.: *Notes on the primary foliage and leaf-scars in Pinus rigida.*—The author exhibited twigs and old bark of this pine and discussed the foliar morphology, suggesting the possible affinity of some fossil plants commonly grouped with pteridophytes with the pines. The resemblance between the primary leaf-scars and those on the stems of lepidodendrids is certainly striking.

HALSTED, BYRON D.: *Notes on Chalara paradoxa.*—The fungus *Chalara paradoxa* (De Seynes) Sacc. is recorded in Saccardo's Sylloge Fungorum. The writer studied it during the present year as growing upon pineapples. It furnishes the best material thus far met with for illustrating the internal abjunction of spores. When the time arrives for the production of these spores, the tip of the hypha dissolves and the protoplasmic contents become divided serially into a row of hyaline cylindrical spores which are pushed out of the tip of the spore-bearing hypha. While the process of spore formation is at its height the time for the deliverance of a spore may not exceed fifteen minutes.

There is a second form of spore much larger than those above described, that forms in the ordinary way and, not separating readily, produces long necklace chains. There is a third form of spore midway between the two sorts mentioned in that it is produced by internal abjunction but is brown and oval and not hyaline. This is likely a variation due to conditions under which the spores are produced. There are also spores produced within the substance of the host (pineapple flesh) that are still different.

BRITTON, ELIZABETH G.: *A hybrid among the mosses.*—Definite record of hybrids among some species of mosses have been made in Europe. The author here makes the first American record of such a hybrid. The parents are *Aphanorhegma serrata* ♀ × *Physcomitrium turbinatum* ♂ (?). The specimens were distributed as *Schistidium serratum* in Drummond's Southern Mosses no. 20. They show both the normal fruit of one of the parents and the hybrid capsules, growing together from the same stem.

HALSTED, BYRON D.: *Notes upon a root-rot of beet.*—During the present year a serious fungous decay was found upon the roots of field and garden beets. It seems to be an undescribed species of the genus Phyllosticta. The present paper describes the rapid and profuse development of the pycnidia of this fungus upon the cut surface of the affected parts of the beets; the complete separation of the pycnidia by the intervention of a layer of thin cloth laid upon the freshly cut surface; and the confirmation of previous statements regarding the non-sexual origin of the pycnidia.

BRITTON, N. L.: *On Torreya as a generic name.*—As an evidence that the law of homonyms is necessary for stability of nomenclature, the case of Torreya was presented, a generic name which has been applied six times. The record is as follows:

Torreya Raf. (1818) = *Synandra* Nutt. (1818).
Torreya Raf. (1819) = *Pycreus* Beauv. (1807).
Torreya Spreng. (1821) = *Ægiphila* Jacq. (1774).
Torreya Eaton (1833) = *Mentzelia* L. (1753).
Torreya Arnott (1838) = *Tumion* Raf. (1840).
Torreya Croom (1843) = *Croomia* Torr. (1840).

The only one of these genera that has stood has been the Florida taxoid tree of Arnott.

BRITTON, ELIZABETH G.: *Some notes on the genus Encalypta.*—The author compared the European and American specimens of *E. ciliata*, with some notes on *E. longipes* and *E. Macounii.*

HOTCHKISS, JED.: *The growth of forest trees illustrated from marked corners 107 years old.*—Specimens illustrating marks on corner and line trees taken from the Henry Banks

10,980 acre patent, in Greenbrier co., W. Va., surveyed April 18, 1787, were shown. The growth varied from .03 to .05^{in} per year, and the number of growth layers agreed in number exactly with the record.

PATTERSON, MRS. F. W.: *Species of Taphrina parasitic on Populus.*—American mycologists formerly referred to *Taphrina aurea* specimens occurring on ovaries of *Populus tremuloides* and other hosts. It has been shown, however, that the name T. aurea belongs only to the form on leaves, which has not been known heretofore in America. The form on ovaries was then supposed to be identical with Johanson's *T. rhizophora* but from this it now proves to be quite distinct and easily recognized by size of asci as belonging to *T. Johansonii* Sadebeck. A form differing but slightly from T. aurea has now been found also in Iowa, parasitic of several species of Populus planted from Europe.

The following papers were presented in joint sessions of Sections F and G:

BUTLER, A. W.: *Work of the Indiana biological survey.*—An account of the organization of this work by the Indiana Academy of Sciences, its plan and progress.

HOPKINS, A. D.: *Some interesting conditions in wood resulting from the attacks of insects and woodpeckers.*—The author described the modes of attack by which wounds involving twisted grain and various discolorations were brought about. It was stated that the curly or "bird's-eye" grain of poplar was due to the persistent wounds made by the downy woodpecker, and the same cause was suggested for the bird's-eye maple. Further investigations are in progress.

BAILEY, L. H.: *Relation of age of type to variability.*—1. There is a wide difference in variability in cultivated plants. Some species vary enormously. The type of lettuce, cultivated for somewhat less than 2,000 years, was early lost and the cultivated species was named *Lactuca sativa* but it is really the *L. Scariola*. The type of soja bean and of the sweet potato are not known. Of tomatoes the cultivated varieties are more removed from the type than many species are from each other.

2. Variability is not due to age, cultivation, nor geographical distribution.

3. Variability under cultivation is due to some elasticity of the species and is thus inherent.

4. The newer the type the more readily it varies. New types are polymorphous, old types are monomorphous. The most flexible types have not yet passed their zenith, e. g., Cucurbitaceæ. The varieties of cereals are so much alike that expert knowledge is needed to distinguish them.

5. Why are new types flexible? A certain answer cannot be given but the author believes it explicable on the principle of divergence of characters rather than by any rejuvenescence of type.

BAILEY, L. H.: *The struggle for existence under cultivation.*—The struggle for existence under cultivation can be resolved into figures. Seedsmen estimate that one-fourth the seed produced is lost because unsown. (But this is less than nature wastes among wild plants.) Three-fourths therefore engage in the struggle for existence. Only one in thirty or one in twenty of these come to anything. The rest are thinned out. This is a struggle between members of the same species; therefore the struggle sets up a divergence within the species. Added to this is the selective agency of the weeder. The same laws which govern evolution in feral conditions govern evolution under cultivation.

MILES, MANLY: *Limits of biological experiments.*—The author contended that evolutionary laws cannot be demonstrated by direct experiment because of the great number of uncontrollable factors, a point well illustrated by the many valueless feeding experiments.